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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/915,145	07/25/2001	Takeshi Nogami	09792909-5092	6448

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EXAMINER

MAGEE, THOMAS J

ART UNIT

PAPER NUMBER

2811

DATE MAILED: 12/10/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/915,145

Applicant(s)

NOGAMI ET AL.

Examiner

Thomas J. Magee

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2811

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on October 9, 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-11 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-11 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- |                                                                                              |                                                                             |
|----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                  | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____  |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)         | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ | 6) <input type="checkbox"/> Other: _____                                    |

## DETAILED ACTION

### ***Claim Rejections – 35 U.S.C. 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office Action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1 – 9, and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lopatin et al. (US 6,259,160 B1) in view of Dubin et al. (US 5,695,810), Shacham-Diamand ("High Aspect Ratio Quarter-Micron Electroless Copper Integrated Technology," Proc. Materials for Advanced Metallization Workshop (Europe) (1997) pp. 11-14) and Wilson et al. ("Handbook of Multilevel Metallization for Integrated Circuits," Noyes Publ., Westwood, New Jersey (1993), p. 44)

Lopatin et al. disclose a structure containing a barrier liner material (TaN) filled with copper (40,41) (See Figure 1). After subsequent deposition of a copper plug atop the first interconnect, a CoWP layer (60) (See Figure 4) is formed (Col. 7, lines 47 – 48) around the copper as an oxidation resistant layer. A similar CoWP "barrier" layer deposited on copper is disclosed by Dubin et al. (Col. 9, lines 57 – 62) as part of a copper interconnect structure on a semiconductor wafer (Col.9, lines 46 – 47). Lopatin et al. do not disclose the formation of a cobalt silicide cladding layer by CVD on the surface of the CoWP layer. However, Shacham-Diamand et al. disclose the electroless deposition

of copper, followed by electroless deposition of CoWP with deposited films of Co and Si atop the CoWP to produce the sequence, Cu/CoWP/Co/Si, which was subsequently subjected to annealing at 400 degrees (C) for 30 minutes to one hour. The results indicated no interdiffusion and no significant change in resistivity, reducing the affinity for oxidation and corrosion. However, it is also notoriously well known that cobalt silicide is formed from Co/Si at a temperature of 400 degrees (C) (Wilson et al., Table 1, p.44). Hence, it is inherently known that a cobalt silicide layer is formed on the CoWP after annealing. Further, it would have been obvious to one of ordinary skill in the art at the time of the invention to combine the resulting Cu/CoWP/CoSi structure of Shacham-Diamand (1997) with Lopatin et al., Dubin et al., and Wilson et al. to produce a stable structure as a diffusion barrier for copper (plugs and interconnect lines) and outer clad layer (CoWP) resistant to chemical reaction, interdiffusion and oxidation.

5. Claim 10 is duplicative with Claim 7 and has not been considered.

### ***Response to Arguments***

6. Arguments of Applicant have been carefully considered but have not been found to be persuasive. In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so

found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, the disclosure by Shacham-Diamond in 1997 of the deposition of Co/Si on CoWP/Cu with subsequent annealing (producing a cobalt silicide layer) and the resistance to reaction and interdiffusion is a clear motivation for combining. Further, in response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

### **Conclusions**

7. Applicant's arguments with respect to claims 1 - 10 have been considered but are moot in view of the new ground(s) of rejection. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

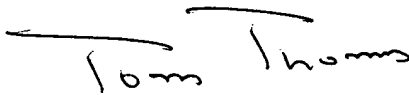
A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the

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shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the Examiner should be directed to **Thomas Magee**, whose telephone number is **(703) 305-5396**. The Examiner can normally be reached on Monday through Friday from 8:30AM to 5:00PM (EST). If attempts to reach the Examiner are unsuccessful, the examiner's supervisor, **Tom Thomas**, can be reached on **(703) 308-2772**. The fax number for the organization where this application or proceeding is assigned is **(703) 308-7722**.

Thomas Magee  
December 3, 2002

  
TOM THOMAS  
SENIOR PATENT EXAMINER  
TECHNOLOGY CENTER 2800